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NEW *COLOSTETHUS* (AMPHIBIA, DENDROBATIDAE)
FROM SOUTH AMERICA

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ABSTRACT. Six new species of *Colostethus* are described from South America: *C. mittermeieri*, *C. idiomelus*, and *C. poecilonotus* from Peru; *C. maculosus* and *C. paradoxus* from Ecuador; and *C. faciopunctulatus* from Colombia. *C. maculosus* and *C. faciopunctulatus* belong to group VI (Rivero and Serna, 1988), *C. mittermeieri* and *C. idiomelus* to group I, *C. poecilonotus* belongs to group IX, and *C. paradoxus* to group IV.

The relationship of the various species is discussed. *C. poecilonotus* is the first member of group IX described from Peru, while *C. paradoxus* is the second member of group IV known from Ecuador. Group IV only extends south to the latitude of Quevedo in northwestern Ecuador. *C. paradoxus* extends the range of the group to southern Ecuador. However, the possibility that the dilated third finger, which characterizes male members of group IV, may have arisen independently on more than one occasion is discussed.

INTRODUCTION

Examination of the *Colostethus* collection at the Museum of Comparative Zoology revealed a number of undescribed species from Peru, Ecuador, and Colombia. From these undescribed species a great deal is learned regarding their mutual relationships and the delimitation of the groups the genus has been divided into (Rivero, 1988).

All the described species are well characterized and one of them is quite unique, so unique indeed that it cannot easily be assigned to any of the known groups of *Colostethus*. Yet, most of the groups, as originally suggested (Rivero, 1988), seem to have withstood

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trial, although a few definitions may require modification. The division of the original group VI into groups VI and IX follows Rivero and Serna, 1988. A description in English (expanded from the original in Spanish) of the Andean groups occurring from Colombia to Peru is provided here.

Many of the proportions usually incorporated into descriptions have been omitted here (diameter of tympanum in relation to eye diameter, diameter of eye in relation to the distance between eye and nostril, etc.) as they can easily be determined from the measurements. When many specimens were available, averages and proportions are provided in a *Variation* section.

Most measurements were taken with a compass; snout-vent length, head breadth, and length of tibiae, with calipers. Head length was measured between the posterior edge of the tympanum and the tip of the snout.

The web between the toes is considered insignificant if it does not extend beyond the midpoint of the first subarticular tubercle in at least four toes, minimal if it extends to the anterior border of the first subarticular tubercle in at least four toes ($\frac{1}{4}$ -webbed), intermediate if it extends beyond the first subarticular tubercle but does not reach the last articulation (disk) in at least three toes, and extensive if it reaches the last articulation in at least four toes. The central and usually indented part of the web is the portion considered for determining its extension. Considering the individual variation, a more detailed description is unnecessary and may make comparisons more difficult. However, the pedal membrane of all holotypes is illustrated in the corresponding figures.

The author wants to thank E. E. Williams and J. Rosado for all their courtesies and attentions during his stay at the MCZ.

DEFINITION OF GROUPS

Group I. Two pectoral spots present, dorsolateral and ventrolateral stripes absent; oblique-lateral stripes present and usually complete (from eye to groin), rarely absent; pedal membrane absent or insignificant, rarely extensive; third finger of males not dilated; cloacal funnel absent.

Group II. Dorsolateral stripes present; oblique-lateral stripes absent or incomplete (not reaching the eye); ventrolateral stripes

present or absent; pedal membrane absent or insignificant; paired pectoral spots absent; third finger of male not dilated; cloacal funnel absent.

Group IV. Third finger of males dilated; dorsolateral stripes usually absent; oblique-lateral stripe present or absent; ventrolateral stripe generally absent; pedal membrane absent or insignificant (except in Colombian *C. agilis*); paired pectoral spots absent; cloacal funnel absent.

Group V. Cloacal funnel present; dorsolateral stripe absent or indistinct; oblique-lateral stripe absent; ventrolateral stripe absent; pedal membrane extensive; paired pectoral spots absent; third finger of male not dilated.

Group VI. Pedal membrane usually extensive, at least $\frac{1}{3}$ the length of the toes; first finger generally shorter than second; dorsal color usually blackish, sometimes marbled or spotted; dorsolateral stripes absent or not extending posteriorly beyond sacral hump; oblique-lateral stripes absent or incomplete; ventrolateral stripes generally absent; paired pectoral spots absent; third finger of male not dilated; cloacal funnel absent.

Group IX. Dorsolateral stripes absent; oblique-lateral stripes present and usually complete (from eye to groin); ventrolateral stripes generally absent; pedal membrane absent or insignificant; paired pectoral spots absent; third finger of male not dilated (this last character distinguishes this group from group IV); cloacal funnel absent.

DESCRIPTION OF SPECIES

Colostethus mittermeieri, sp. nov.

Figs. 1a–d

Holotype. MCZ-A 100217, an adult female from Venceremos, 394–395 km, on Marginal de la Selva Road, 1,620 m, Departamento de San Martín, Perú. Collectors: R. A. Mittermeier and H. Macedo Ruíz, 26 Sept. 1978.

Paratypes. MCZ-A 100218–57. Forty specimens with the same data as the type.

Etymology. *Mittermeieri*, in honor of Russell A. Mittermeier, one of the collectors of the species, and recent recipient of the N.Y. Zoological Society's Conservation Medal.

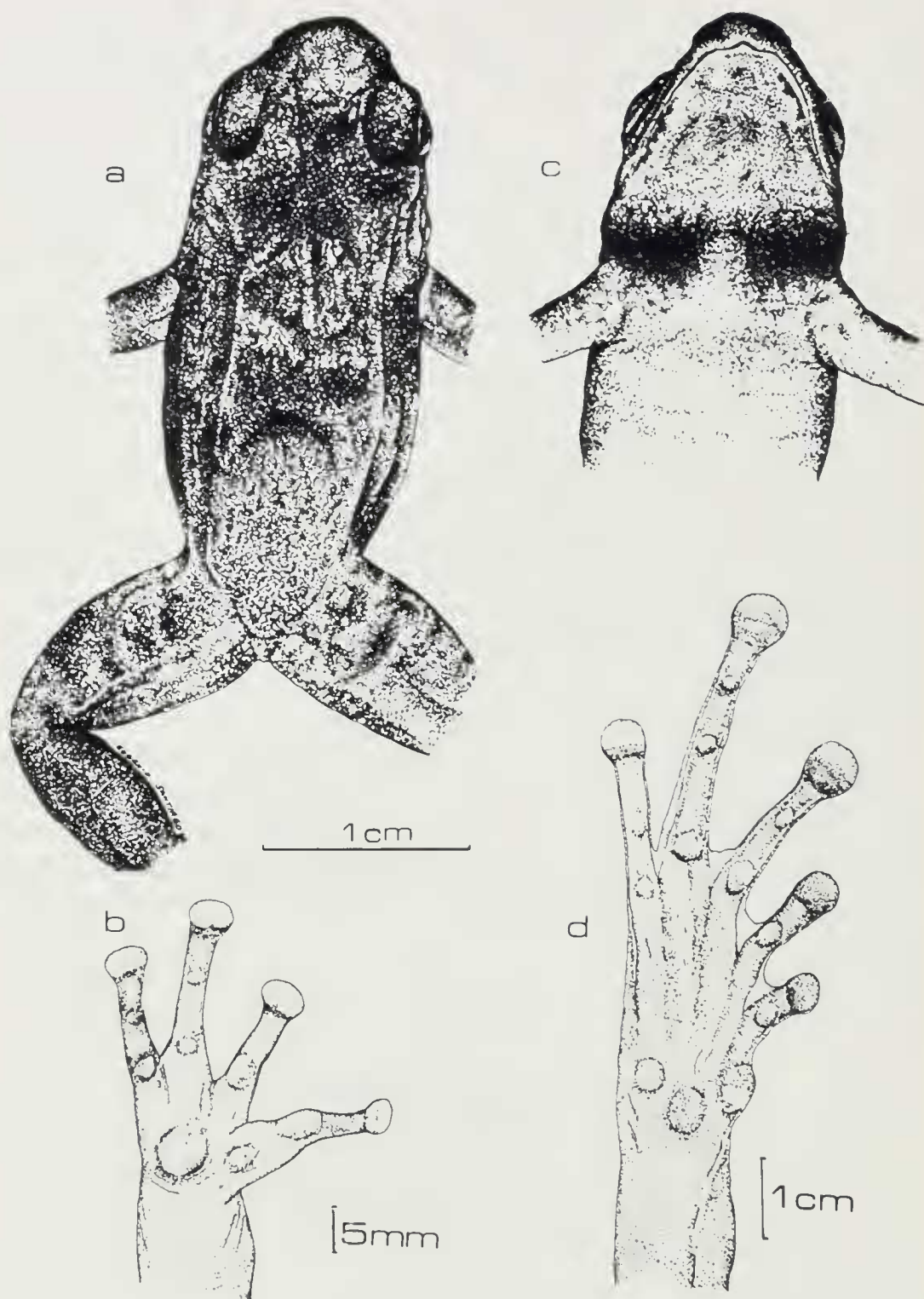


Figure 1. MCZ-A 100217, holotype of *Colostethus mittermeieri*, (a) dorsal view; (b) ventral view of hand; (c) throat and chest; (d) ventral view of foot.

Diagnosis. A fairly large member of group I (Rivero, 1988) with $\frac{1}{4}$ -webbed toes, first finger shorter than second, fingers without lateral fringes, toes with distinct lateral fringes, venter almost always marbled, especially on the anterior half, males without vocal slits, no ventral sexual dichromatism, flanks with contrasting and sometimes elongated spots, digital disks broader than distal segments, and no dorsolateral, oblique-lateral, or continuous and distinct ventrolateral stripe.

Description of Holotype. Tip of snout broadly triangular beyond nostrils, almost vertical when seen from the side; nostrils antero-lateral, slightly protuberant; tongue spatulate, nicked behind, about $\frac{2}{3}$ free; choanae rounded; canthus rostralis well defined, angular, curved; loreal region flat, vertical; tympanum moderate, covered posterodorsally by skin; external metacarpal tubercle rounded, prominent; internal tubercle elongate, prominent; palm of hand smooth, with a slight ridge along outer margin; proximal subarticular tubercles of first two fingers large, prominent; proximal of outer two fingers smaller, less distinct; distal of outer two fingers reduced, inconspicuous; first finger shorter than second, second shorter than last; fingers without lateral fringes; disks large, broader than distal digital segments; first disk slightly smaller than second and fourth; third disk about $\frac{3}{4}$ size of tympanum; a distinct, oblique tarsal fold extending to inner subarticular tubercle; three metatarsal tubercles, inner more elongated, central less prominent, than outer; plantar surfaces smooth, with a distinct ridge along outer margin; toes with a minimal web; toe disks broader than distal digital segments; first disk smaller than others; all toes with distinct lateral fringes; heel of adpressed hind limb extending anteriorly to middle of eye.

Head smooth; dorsal surfaces behind head covered with flat, minute warts sometimes fusing to form short ridges; a few tubercles behind sacral hump, in the proximity of cloacal opening; two or three tubercles between tympanum and arm; flanks with small, flat warts and glandular ridges; loreal region smooth; a few tubercles on dorsal surface of arms and a few others on antero-ventral surfaces of upper arm; venter smooth except for some indistinct granules on the posterior lateral margins of abdomen; ventral surface of thighs smooth.

Color. Dorsum solid dark grayish brown; loreal region, upper lip and temporal area lighter than dorsum; flanks the same color as dorsum but with a few distinct white spots near groin and a white streak that extends from axilla to $\frac{2}{3}$ distance from axilla to groin; white streak shorter and not extending to axilla on left side; a white or discolored area at attachment of forelimb; black longitudinal streaks along anterior and posterior aspects of forearms or thighs absent; posterior aspect of thighs with indistinct blackish marbling on a greenish yellow background; dorsal aspect of thigh with indistinct transverse blotches or bars.

Throat and anterior part of belly infuscated, this color more concentrated on throat and chest, with two extensive black spots discernible; sides of belly with some infuscation and marbling; dorsolateral, continuous ventrolateral, and oblique-lateral stripes absent; a few indistinct whitish spots or bars on anterior aspect of thighs.

Variation. Almost always the dorsal color of adults is solid dark grayish brown or blackish, but it may be lighter gray in an occasional specimen, and indistinct darker spots may be discerned in some specimens, particularly the young ones. Transverse bars on the limbs may also be distinct in juveniles but are rarely so in adults.

The white spots of the flanks may vary in distinctness and may not be apparent in some juveniles. The ventrolateral streak may be continuous between groin and axilla, it may be broken into a series of longitudinal spots, or it may be limited to a few anterior spots. It never has either the smooth margins or the continuity of the ventrolateral streak in members of groups II and IV, nor does it extend anteriorly beyond the origin of the arm. The discolored area at the attachment of the forelimb is present in most specimens but is not apparent in those in which the limbs are of a light color.

A marbled and spotted ventral pattern may not be apparent in a few specimens (N5) but it is usually present. Infuscation of the throat and chest is generally present, but again, an occasional specimen may be of a plain white color, except for the two spots on the chest. In some specimens with a distinct marbled pattern on the anterior venter, the knee may also be marbled and/or spotted.

The white spots on the anterior aspect of the thigh may be quite distinct, and in some specimens there is a row of white spots along the posterior margin of the thigh and tibial segment.

In one female specimen, the dorsum is quite tubercular; in others there are small tubercles on the anterolateral area of the dorsum. The indistinct warts and rugosities of the dorsum are generally present but may be absent in young individuals. In the latter the disks are not usually broader than the distal digital segments.

There is some slight variation in the amount of webbing, especially of the first finger, which may be from fully webbed to about half-webbed.

The tubercles on the forearm may be quite abundant and distributed all along the anterior and posterior surfaces, or limited to a few, which form an irregular row on the posterior face of the arm. The belly is usually smooth, but a few specimens have granules on the distal third of the belly, on the sides, and/or on the ventral surface of the thighs.

None of the 10 recognizable males in the group is larger than 20 mm and none has vocal slits. The latter characteristics may be a sign of immaturity; however, these specimens' testicles seem to be well developed. There may be a distinct size dimorphism in this species.

Measurements and Proportions. See Tables 1a and 1b.

Discussion. *Colostethus mittermeieri* is a member of group I, whose most distinctive feature is the presence of two dark pectoral spots.

Group I has 12 species, six of which are yet to be described (Edwards, 1974; Rivero, 1988). The group ranges from southern Colombia to Peru south to Cerro de Pasco. In the Peruvian Andes it is the dominant group and the only one in their highest elevations, but it occurs, as do groups VI and II, on the eastern flank of the cordillera.

The only member of group I so far known from the lowland is *C. littoralis*, described from Lima, but this form is apparently identical with a species from Ancash and may have been taken to the coast, either intentionally or accidentally. The small coastal population seems to have disappeared now but the name *C. littoralis* prevails for the mountain form.

Table 1a. *Colostethus mittermeieri* males, measurements and proportions.

Catalog No.	100228	100224	100233	Average
SV	19.00	17.45	15.30	17.25
HB	6.65	6.20	5.40	6.08
HL	7.70	6.30	5.50	6.50
ETS	3.60	3.35	2.80	3.25
EN	1.95	1.70	1.80	1.82
IOS	2.10	2.30	2.05	2.15
UE	1.80	1.60	1.50	1.63
ED	2.80	2.45	2.50	2.58
DT	1.20	0.95	1.20	1.12
LF	8.70	7.90	7.20	7.93
LT	8.90	8.30	7.35	8.18
LFT	8.70	7.60	6.50	7.60
HB/SV	0.35	0.36	0.35	0.35
HL/SV	0.41	0.36	0.36	0.38
UE/IOS	0.86	0.70	0.73	0.76
DT/ED	0.43	0.39	0.48	0.43
ED/ETS	0.78	0.73	0.89	0.80
ED/EN	1.44	1.44	1.39	1.42
LF/SV	0.46	0.45	0.47	0.46
LT/SV	0.47	0.48	0.48	0.47
LFT/SV	0.46	0.44	0.42	0.44
LF/LT	0.98	0.95	0.98	0.97

Key: SV = snout-vent length; HB = head breadth; HL = head length; ETS = distance between eye and tip of snout; EN = distance between eye and nostril; IOS = breadth of interorbital space; UE = breadth of upper eyelid; ED = eye diameter; DT = tympanic diameter; LF = length of femur; LT = length of tibia; LFT = length of foot.

C. mittermeieri is distinguished from all other members of the group, with the exception of an undescribed species from Dos Ríos in Pichinga, Ecuador, by lacking an oblique-lateral stripe. It is also the most extensively webbed species, as in all the others the toes are either free or have an insignificant web.

Most of the Peruvian members of group I are distinctly spotted above. *C. mittermeieri* is not usually spotted, but when spotted, the spots are not distinct and contrasting. On the other hand, the white lateral spots are usually distinct and very contrasting, and one of the lower ones may form a usually discontinuous, undu-

Table 1b. *Colostethus mittermeieri* females, measurements and proportions.

Catalog No.	100234	100250	100256	100249	100247	100217	100244	100229	100242	100257	100245	100241	Aver- age
SV	24.70	29.25	23.50	28.00	27.50	28.00	19.35	28.00	23.00	27.80	20.20	21.00	25.03
HB	8.50	9.50	8.25	9.50	8.70	9.50	7.00	9.00	7.80	9.25	7.10	7.65	8.48
HL	8.30	8.75	8.10	10.50	9.25	9.30	6.90	10.30	8.75	9.75	7.30	7.90	8.76
ETS	4.00	4.40	3.70	4.60	4.45	4.20	3.30	4.50	4.00	4.00	3.40	3.50	4.00
EN	2.40	2.70	2.35	2.40	2.50	2.50	1.80	2.50	2.55	2.50	2.00	2.25	2.37
IOS	3.30	3.25	2.75	3.00	3.15	3.25	2.50	3.20	2.65	3.40	2.40	2.40	2.94
UE	2.35	2.60	2.25	2.50	2.50	2.55	2.00	2.45	2.25	2.60	2.00	2.05	2.34
ED	3.15	3.85	3.35	4.00	3.70	3.65	3.10	3.55	3.35	3.75	3.05	3.30	3.48
DT	1.25	1.85	1.25	1.75	1.50	1.70	1.20	1.65	1.50	1.75	1.15	1.30	1.49
LF	11.65	12.90	10.90	13.00	11.60	13.40	9.50	12.95	10.10	13.00	9.30	10.05	11.53
LT	12.15	13.40	11.60	13.35	13.75	12.90	10.00	13.45	11.80	14.10	10.25	11.10	12.32
LFT	11.30	12.65	10.40	12.75	11.90	12.00	8.55	11.35	10.65	12.35	9.40	10.95	11.19
HB/SV	0.34	0.32	0.35	0.34	0.32	0.34	0.36	0.32	0.34	0.33	0.35	0.36	0.34
HL/SV	0.34	0.30	0.34	0.38	0.34	0.33	0.36	0.37	0.38	0.35	0.36	0.38	0.35
UE/IOS	0.71	0.80	0.82	0.83	0.79	0.78	0.80	0.77	0.85	0.76	0.83	0.85	0.80
DT/ED	0.40	0.48	0.37	0.44	0.41	0.47	0.39	0.46	0.45	0.47	0.38	0.39	0.42
ED/ETS	0.79	0.88	0.91	0.87	0.83	0.87	0.94	0.79	0.84	0.94	0.90	0.94	0.87
ED/EN	1.31	1.43	1.43	1.67	1.48	1.46	1.72	1.42	1.31	1.50	1.53	1.47	1.48
LF/SV	0.47	0.44	0.46	0.46	0.42	0.48	0.49	0.46	0.44	0.47	0.46	0.48	0.46
LT/SV	0.49	0.46	0.49	0.48	0.50	0.46	0.52	0.48	0.51	0.51	0.51	0.53	0.49
LFT/SV	0.46	0.43	0.44	0.46	0.43	0.43	0.44	0.41	0.46	0.44	0.47	0.52	0.45
LF/LT	0.96	0.96	0.94	0.97	0.84	1.04	0.95	0.96	0.86	0.92	0.91	0.91	0.94

For key to characters see Table 1a.

lating line from the axilla to the proximity of the groin. The streak may not be analogous to the ventrolateral streak of groups II and IV.

Colostethus idiomelus, sp. nov.

Figs. 2a-c

Holotype. MCZ-A 100260, an adult female from Venceremos, 394–395 km, on Marginal de la Selva Road, 1,620 m, Departamento de San Martín, Perú. Collectors: R. A. Mittermeier and H. Macedo Ruíz, 26 Sept. 1978.

Etymology. *Idiomelus*, from the Greek *idio*, distinct, peculiar, and *melos*, limb, in reference to the strikingly colored hind limbs of the species.

Diagnosis. A medium-sized member of group I with small pectoral spots, no dorsolateral or ventrolateral stripes, oblique-lateral stripe present and extending to the eye, first finger shorter than second, a short basal web between toes I and II, and II and III, a narrow lateral fringe on the inner side of toes II and III, fingers and toes long and slender, the disks small, much smaller than the tympanum, and the thighs with distinct transverse blotches on a white background.

Description of Holotype. Snout short, the tip rounded, more or less vertical when seen from the side; nostrils anterolateral, not protruding, very near end of snout; tongue spatulate, broad, nicked behind, about $\frac{2}{3}$ free; choanae small, ovate; canthus rostralis rounded but angular, not appreciably curved; loreal region vertical, flat; tympanum flushed with surface, covered posterodorsally by skin; external metacarpal tubercle rounded, obliquely ridged; internal tubercle smaller, elongate; palm of hand smooth, with a narrow ridge along outer margin; basal subarticular tubercles of fingers I, II, and III large, distinct; distal tubercle of finger III and basal and distal tubercles of finger IV smaller and less distinct; fingers long, slender; first finger slightly shorter than second, second shorter than last; fingers without lateral fringes; disks small, approximately equal in size and slightly broader than distal digital segments; disk of third finger about $\frac{1}{3}$ size of tympanum; an oblique, internal tarsal fold extending to inner metatarsal tubercle; metatarsal tubercles prominent; outer tubercle more or less rounded; inner, elongate; plantar surfaces smooth and with

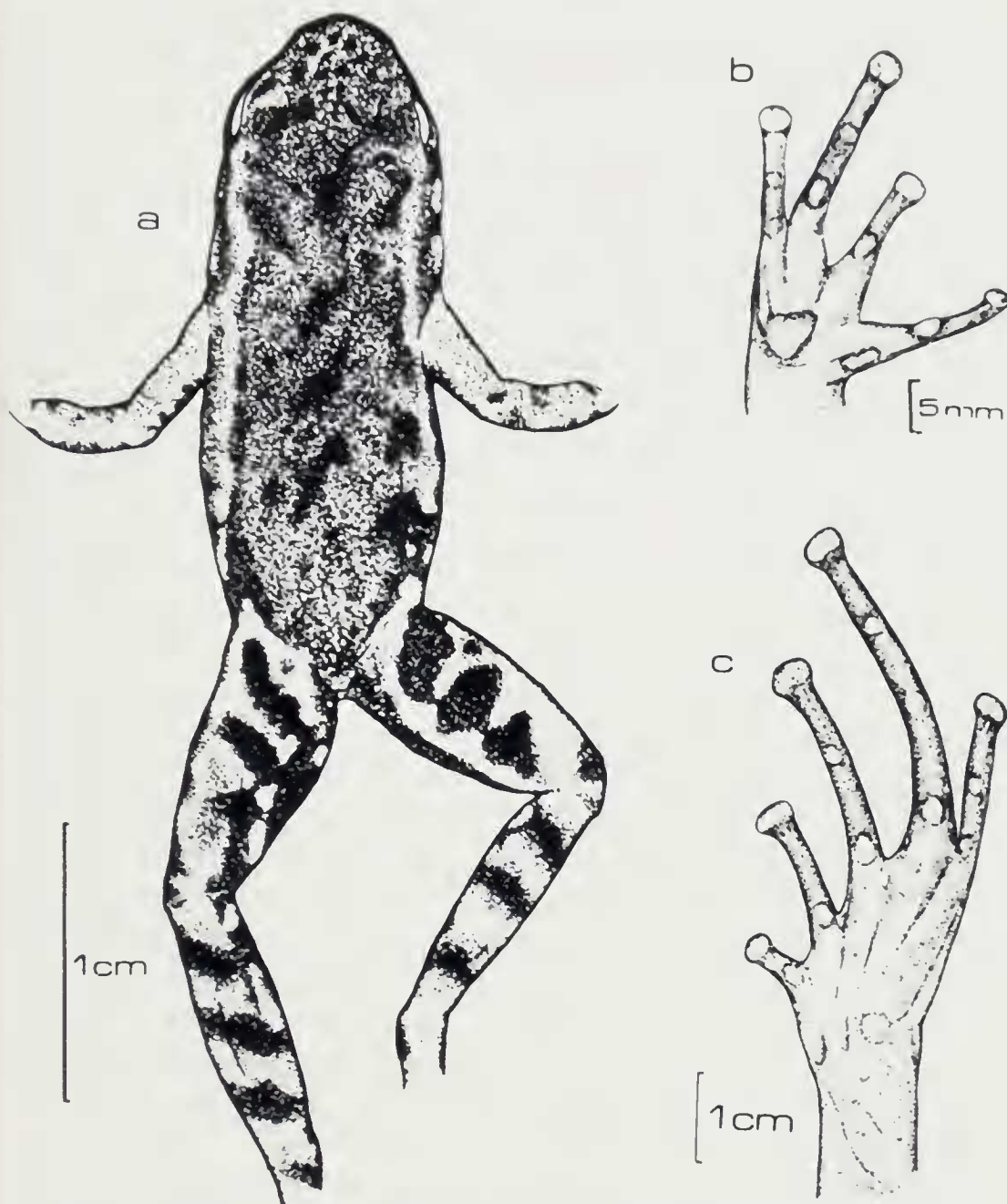


Figure 2. MCZ-A 100260, holotype of *Colostethus idiomelus*, (a) dorsal view; (b) ventral view of hand; (c) ventral view of foot.

distinct outer ridge extending as narrow keel along outer edge of fifth toe; toes slender, with insignificant web; disks of toes small; first disk not broader than digit; others slightly broader; heel of adpressed hind limb extending anteriorly to middle of eye.

Dorsum smooth on head and anterior part of body but with indistinct flat warts increasing in size near cloacal opening; loreal region and flanks smooth; a tubercle between tympanum and arm;

three or four small tubercles along posterior surface of lower arm; ventral surfaces, including posterior surface of thighs, smooth.

Color. Dorsum grayish brown with moderately contrasting blotches and spots which are much smaller on snout and head; a black streak on each side, from behind eye, crossing groin area and continuing along anterior border of thigh to knee; an oblique, white (red?) stripe crossing base of thighs and on one side continuing as a longitudinal stripe along posterodorsal margin, on other, breaking into a series of spots; anterior part of thighs white, this color getting dusky at fusion with white streak or spots on posterodorsal margin; white or whitish area crossed by three very distinct and contrasting dark brown spots or bars; posterior part of thighs behind white streak (or series of spots) dark brown, lighter and profusely spotted with white at proximal end; rest of hind limbs light brown with darker crossbands; a short dark brown streak on anterior part of upper arm and a longer one on posterior portion of same segment; a small, dark brown spot around nostril; a dark canthal streak continuing to tip of snout but not meeting contralateral streak; exposed part of tympanum white; upper lip and temporal area dusky, with spots below anterior and posterior corners of eye and smaller spots between these and below canthal streak; a whitish oblique-lateral stripe from behind eye to proximity of groin; groin area very dark brown, with distinct and contrasting white spots, one of which extending into white, oblique streak at base of thighs; the brown color, on the other hand, extending into black streak along anterior aspect of thighs; ventral surfaces immaculate except for a dusky line along margin of lower jaw and two tiny pectoral spots.

Measurements (mm). Snout-vent 25.3; head length 8.2; head breadth 8.1; eye diameter 3.0; eye-nostril 2.0; eye-tip of snout 4.0; upper eyelid 2.0; interorbital space 3.0; femur 12.0; tibia 12.2; foot 12.5.

Discussion. *Colostethus idiomelus* shares with most of the other Peruvian members of group I the oblique lateral stripe and the spotted coloration of the dorsum. *Colostethus sylvaticus*, *C. elachyhistus*, and *C. littoralis*, the other described members of group I, have a greater amount of webbing and a distinct lateral fringe on all toes. None has the striking coloration of the thighs nor the white spots on the flank that seem to characterize *C. idiomelus*.

Two undescribed species were considered by Edwards in his thesis (1974). In one, from Ancash, there is no pedal webbing and the oblique-lateral line does not extend to the eye; in the other, from Huánuco, fingers and toes are fringed, the flanks are dark brown, with a number of yellowish flecks and the dorsal surfaces of the limbs are olive tan with brown bars or spots.

A third species collected by Edwards near Zamora in Ecuador, but not yet described, has a yellow spot at the insertion of the arm and brown legs with small black spots and transverse bars.

Colostethus idiomelus is more typical of group I than *C. mittermeieri*. It differs from that species, among other things, in having black streaks along the anterior and posterior aspect of the upper arms, in having a reduced amount of webbing, no blackening of the throat, very small pectoral spots, and an oblique-lateral streak.

Colostethus poecilonotus, sp. nov.

Figs. 3a–c

Holotype. MCZ-A 89108, an adult female from between Chachapoyas and Bagua Grande Alva, 500 m, Departamento Amazonas, Perú. Collector: R. A. Mittermeier, 3 May 1974.

Paratypes. MCZ-A 89106–7, 89109, all adults and with the same data as the type.

Etymology. *Poecilonotus*, from the Greek *poikilos*, variegated, spotted, mottled, and *notos*, back, in reference to the spotted dorsum of this species.

Diagnosis. A small *Colostethus* probably belonging to group IX, with granular, spotted dorsum, no dorsolateral or ventrolateral stripes, oblique-lateral stripe present and not extending beyond level of axilla, first finger equal in length to second, fingers without lateral fringes, toes free and without lateral fringes, first and fifth toe disks scarcely broader than the respective distal digital segments, venter immaculate, granular on the posterior portion.

Description of Holotype. Tip of snout slightly convex beyond nostrils and slightly inclined inwards towards lip when seen from the side; nostrils anterolateral, slightly protruding; tongue spatulate, entire, $\frac{2}{3}$ free; choanae small, rounded; canthus rostralis sharp and angular, curving towards nostrils; loreal region flat, vertical; tympanum conspicuous, posterodorsally covered by skin;

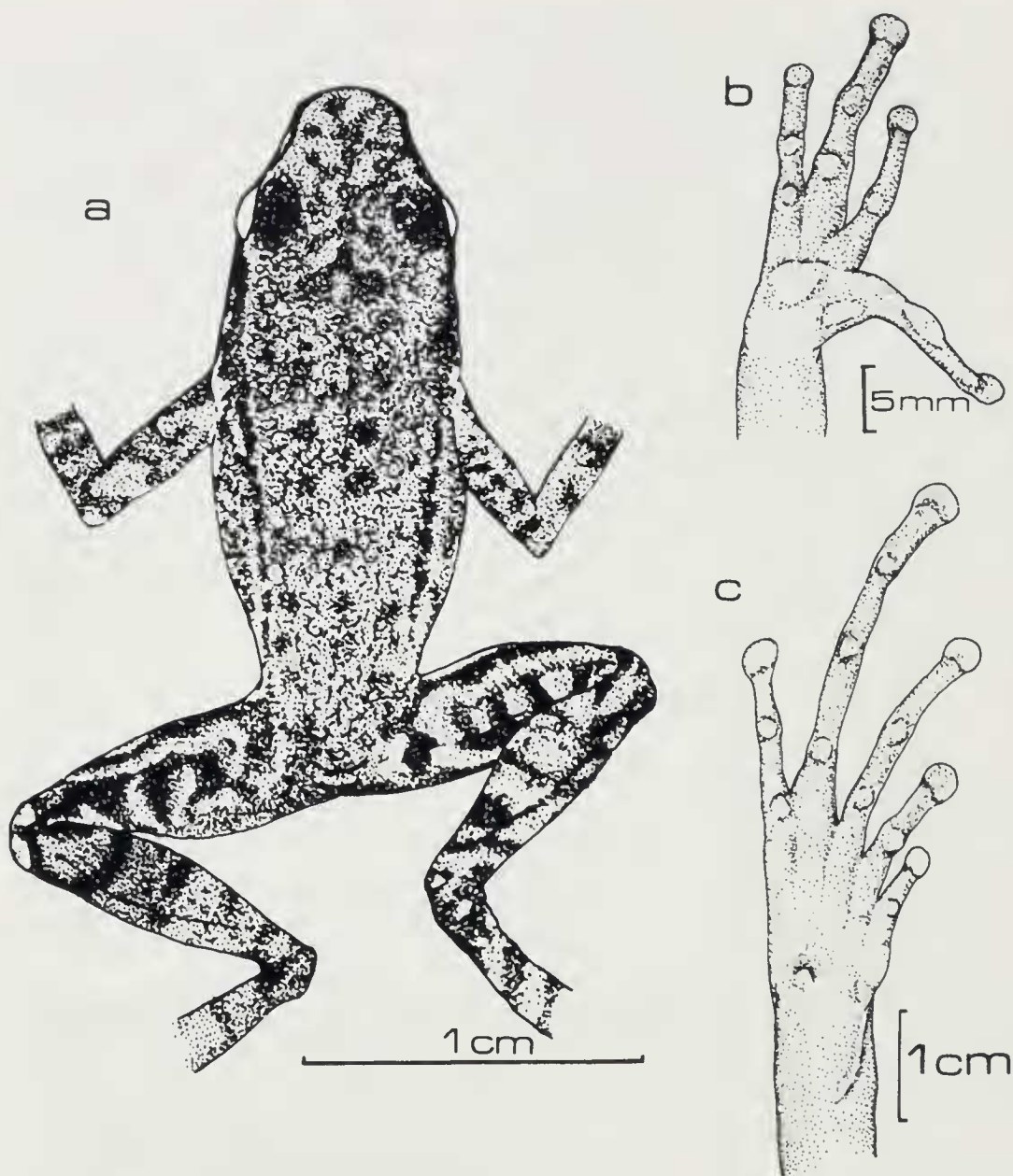


Figure 3. MCZ-A 89108, holotype of *Colostethus poecilonotus*, (a) dorsal view; (b) ventral view of hand; (c) ventral view of foot.

external metacarpal tubercle rounded, very protuberant; inner tubercle elongated and smaller; palm of hand rugose but without supernumerary tubercles and with a ridge along outer margin; subarticular tubercles prominent, the second of third finger and the two of fourth, the smallest (with the latter more prominent than the former); first finger equal in length to second, second slightly longer than last; fingers slender and without lateral fringes; disks of fingers small, all of approximately equal size and slightly

broader than corresponding digital segments; disk of third finger not more than $\frac{1}{4}$ size of tympanum; a short, oblique tarsal tubercle extending as a thin, inconspicuous ridge to inner metatarsal tubercle; inner metatarsal tubercle elongate, longer than the smaller, rounded, and conical outer tubercle; plantar surfaces smooth and with a narrow external fold extending along outer margin of fifth toe to disk; subarticular tubercles of toes small, but conical and protuberant; toes long and slender, free; fourth toe with narrow, indistinct lateral keels on outer segments; first and last disks the smallest and not broader than the corresponding distal digital segments; heel of adpressed hind limb extending anteriorly to between eye and nostril.

Dorsum granular, the granules tending to be more prominent towards posterior end; limbs granular and tubercular; upper eyelids granular; loreal region smooth; flanks granular and tubercular, especially towards groin; two small tubercles between tympanum and arm; throat smooth; abdomen granular on posterior third; posterior aspect of thighs smooth; two or three tubercles along anterior margin of lower arm.

Color. Brownish tan with distinct, darker spots and a distinct whitish oblique-lateral stripe from level of axilla to groin; a black canthal stripe continuing, in back of eye, to about level of arm insertion, after which, continuing posteriorly as a thin stripe above oblique-lateral stripe to groin; upper flanks brownish, with two or three whitish spots near groin; face, lower part of tympanum, and temporal area whitish, this color continuing above arm insertion to lower flanks; an indistinct, brown longitudinal line along anterior face of upper arm and also along anterior face of thighs; hind limbs with narrow cross-bars and spots; posterior aspect of thighs approximately of same color as dorsal surfaces; venter immaculate.

Variation. Paratype MCZ-A 89109 is very similar to the type in coloration, but the black streak above the oblique-lateral line is not easily discernible, the longitudinal line of the upper arm is very short, there are no white spots on the posterior aspect of the flanks, and all disks are broader than the respective digital segments.

In MCZ-A 89107 the dorsal spotting is less contrasting, the loreal region and face are more infuscated or spotted, and the

Table 2. *Colostethus poecilonotus* females, measurements and proportions.

Catalog No.	89106	89107	89108	89109	Average
SV	21.70	24.65	20.50	19.70	21.64
HB	7.20	7.65	7.00	6.20	7.01
HL	8.80	9.45	8.35	7.60	8.55
ETS	3.80	3.85	3.65	3.35	3.66
EN	2.10	2.20	2.10	1.85	2.06
IOS	2.75	3.00	2.80	3.90	2.86
UE	1.85	1.90	1.55	1.40	1.68
ED	3.00	3.20	2.95	2.80	2.99
DT	1.50	1.70	1.45	1.40	1.51
LF	9.80	10.30	9.80	8.90	9.70
LT	10.85	11.05	10.80	9.55	10.56
LFT	10.10	10.00	10.10	9.00	9.80
HB/SV	0.33	0.31	0.34	0.31	0.32
HL/SV	0.41	0.38	0.41	0.39	0.40
UE/IOS	0.67	0.63	0.55	0.48	0.59
DT/ED	0.50	0.53	0.49	0.50	0.51
ED/ETS	0.79	0.83	0.81	0.84	0.82
ED/EN	1.43	1.45	1.40	1.51	1.45
LF/SV	0.45	0.42	0.48	0.45	0.45
LT/SV	0.50	0.45	0.53	0.48	0.49
LFT/SV	0.47	0.41	0.49	0.46	0.46
LF/LT	0.90	0.93	0.91	0.93	0.92

For key to characters see Table 1a.

dark lateral band is broad and has the oblique-lateral line within its confines. The dorsum of this specimen is more tubercular than in the type and there is a central tubercle between inner and outer metatarsal tubercles.

In MCZ-A 89106 there is more spotting on the flanks and some marbling behind the axilla. In both this specimen and MCZ-A 89107 the thighs are marbled dark brown on a lighter brown color.

In most specimens, the oblique-lateral line tends to become whiter, broader, and more distinct as it approaches the groin, and the elbow, the knee, and the heel tend to show a discolored area or spot, but it could not be ascertained if this was the result of erosion or if it is a natural spot.

The lateral keels on the distal segments of the fourth toe are not evident in some specimens and cannot be described as fringes.

Measurements and Proportions. See Table 2.

Discussion. *Colostethus poecilonotus* is the first member of group IX described from Peru. Yet, its presence here is not unexpected as the group is known from southeastern Ecuador, where it is represented by at least three species. One of these, *C. festae* is little known but it is supposed to have a short web and no oblique-lateral stripe. The others, reported by Edwards (1974) but not yet described, may have a web, fringes on the toes, or a marbled venter.

Sometimes, individuals of species belonging to group I may not have the pectoral spots that are diagnostic of the group. Thus, *C. poecilonotus* may actually be a member of group I, which is the most typical group in Andean Peru. There is no way of knowing, however, until more specimens become available.

Only one undescribed member of group I reported from Peru (Edwards, 1974) lacks toe webbing, but in this species there are fringes on the fingers and toes, and the first finger is longer than the second.

Colostethus maculosus, sp. nov.

Figs. 4a–c

Holotype. MCZ-A 91558, an adult male from Puyo, between Turgina and theatre, 950 m, Provincia Pastaza, Ecuador. Collectors: K. Miyata and H. Weed, 22 July 1976.

Paratype. MCZ-A 104946, an adult male from El Reventador (ca. 1,200 m), Provincia Napo, Ecuador. Collector: Giovanni Onore, Leg. June, 1983.

Etymology. *Maculosus*, from the Latin *maculosus*, spotted, mottled, in reference to the color of the dorsum in this species.

Diagnosis. A medium-size *Colostethus* referable to group VI, with mostly smooth and spotted dorsum, first finger shorter than second and second much shorter than fourth, vesicular inflammation at base of third finger, extensively webbed toes, no dorsolateral or ventrolateral stripes, but variously distinct, oblique-lateral line present, black lateral band not extending posteriorly behind arm, and immaculate venter.

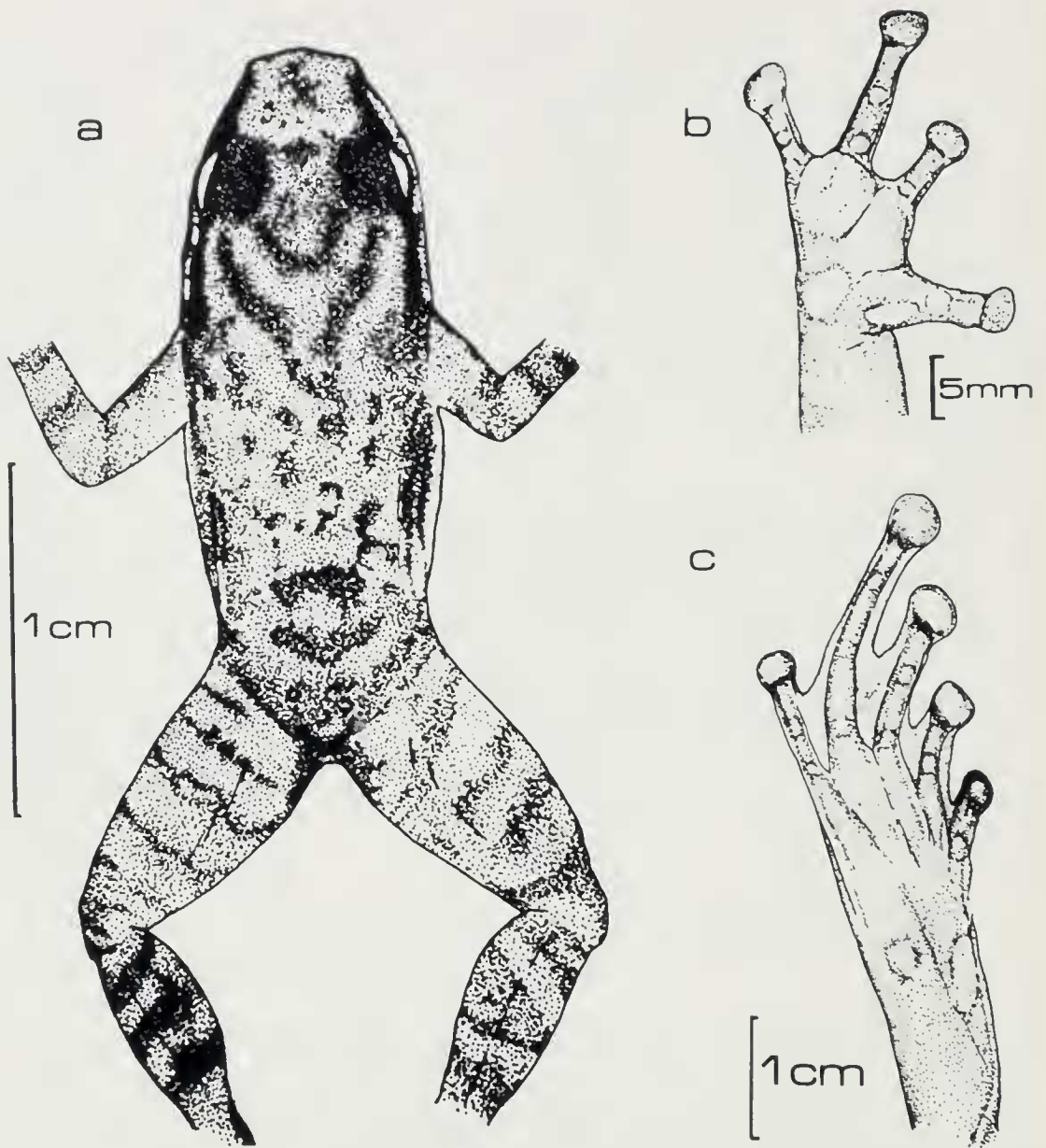


Figure 4. MCZ-A 91558, holotype of *Colostethus maculosus*, (a) dorsal view; (b) ventral view of hand; (c) ventral view of foot.

Description of Holotype. Tip of snout almost truncate, slightly inclined inwards towards the lip when seen from the side; nostrils anterodorsal, scarcely protruding; tongue narrow, ovoid, nicked behind, and nearly $\frac{1}{2}$ free; choanae small, rounded; canthus rostralis sharply angular; loreal region vertical, flat; tympanum moderate, covered posterodorsally by skin; external metacarpal tubercle large, rounded, protuberant; internal tubercle smaller,

elongate, and less prominent; palm of hand smooth, with a distinct pad or cushion at base of third finger; an indistinct outer ridge along outer margin of hand; subarticular tubercles rather small, the ones in outer finger the smallest; first finger much shorter than second, second considerably shorter than fourth; fingers flat, without lateral fringes; disks large, the first the smallest, all broader than distal digital segments; disk of third finger about $\frac{3}{4}$ size of tympanum; an oblique tarsal fold continuing along outer margin of first toe to its disk; inner metatarsal tubercle small, elongate; outer tubercle smooth, with a ridge along outer margin; plantar surfaces smooth and with an outer ridge continuing to disk of last toe; subarticular tubercles of toes small, inconspicuous; first toe disk the smallest, followed in size by fifth and second; all disks broader than distal digital segments; toes with an intermediate web; all toes with broad distinct lateral fringes; heel of adpressed hind limb extending anteriorly to middle of eye; a vocal slit on each side, not too close to angle of jaw, and two compact, rugose pouches behind each jaw.

Dorsum smooth except for a few small tubercles at posterior end (under high magnification, dorsum covered with flat, inconspicuous warts); flanks and loreal region smooth; ventral surfaces minutely granular; posterior aspect of thighs smooth.

Color. Dorsum light brown, spotted and mottled with darker brown; an indistinct canthal streak; loreal region, face, and temporal areas light brown, lighter than dorsum; upper flanks approximately the same color as dorsum but with a black band from posterior corner of eye to base of the upper arm; an indistinct, whitish oblique-lateral line from groin to about halfway along flank; hind limb with dark, narrow transverse bars; posterior aspect of thighs same color as dorsum; ventral surfaces immaculate but with some infuscation on throat and chest, especially at base of forelimbs.

Measurements (mm). Snout–vent 21.0; head length 10.0; head breadth 6.8; eye diameter 3.0; eye–nostril 2.0; upper eyelid 2.0; interorbital space 2.3; femur 9.6; tibia 10.3; foot 10.0.

Variation. Specimen MCZ-A 104946 is considered with some misgivings as a paratype, but the presence of the hand pad in both hands of both specimens and the sharing of a very short second finger, much shorter than the fourth, led the author to

believe that they belong to the same species although they may eventually be found to be subspecies of each other.

The paratype is a little larger than the type (22.0 mm), slightly less webbed and more distinctly spotted above, but its most distinctive feature is an oblique-lateral stripe that extends from eye to groin. However, the short oblique-lateral stripe of the holotype may have extended to the eye in the living animal and the anterior portion may have faded in preservation. Until more specimens are collected it is not possible to come to a conclusion.

Discussion. Only three members of group VI have been reported from Ecuador and one of the three is still undescribed (Edwards, 1974). This last species is from Río Azuela, in the same river system and relatively close to Reventador, but in this species there is no oblique-lateral stripe, the first finger is said to be longer or equal to the second, the venter is spotted, and there are lateral fringes on the fingers.

The other members of group VI in Ecuador, *C. fuliginosus* and *C. nexipus*, are quite different from *C. maculosus*, and so is a species from western Ecuador, which will be described elsewhere.

Colostethus paradoxus, sp. nov.

Figs. 5a–d

Holotype. MCZ-A 103924, an adult male from Lamtac, Cuenca, 2,535 m, Provincia Azuay, Ecuador. Collector: Giovanni Onore, April 1982.

Etymology. *Paradoxus*, from the Greek *paradoxos*, strange, contrary to all expectations, in reference to the combination of characters in this species.

Diagnosis. A relatively small *Colostethus* referable to group IV, with dorsolateral and ventrolateral stripes, no oblique-lateral stripe, a dark-colored and well-defined lateral band; a short web between toes II and III, and III and IV, finger disks not broader than the distal digital segments, first finger longer than second, three outer fingers and all toes with a lateral fringe, and male with a dilated third finger.

Description of Holotype. Tip of snout more or less rounded beyond nostrils; rounded when seen from the side; nostrils anterolateral, not protruding; tongue spatulate, entire, not quite $\frac{1}{2}$ free; choanae small, rounded; canthus rostralis rounded but an-

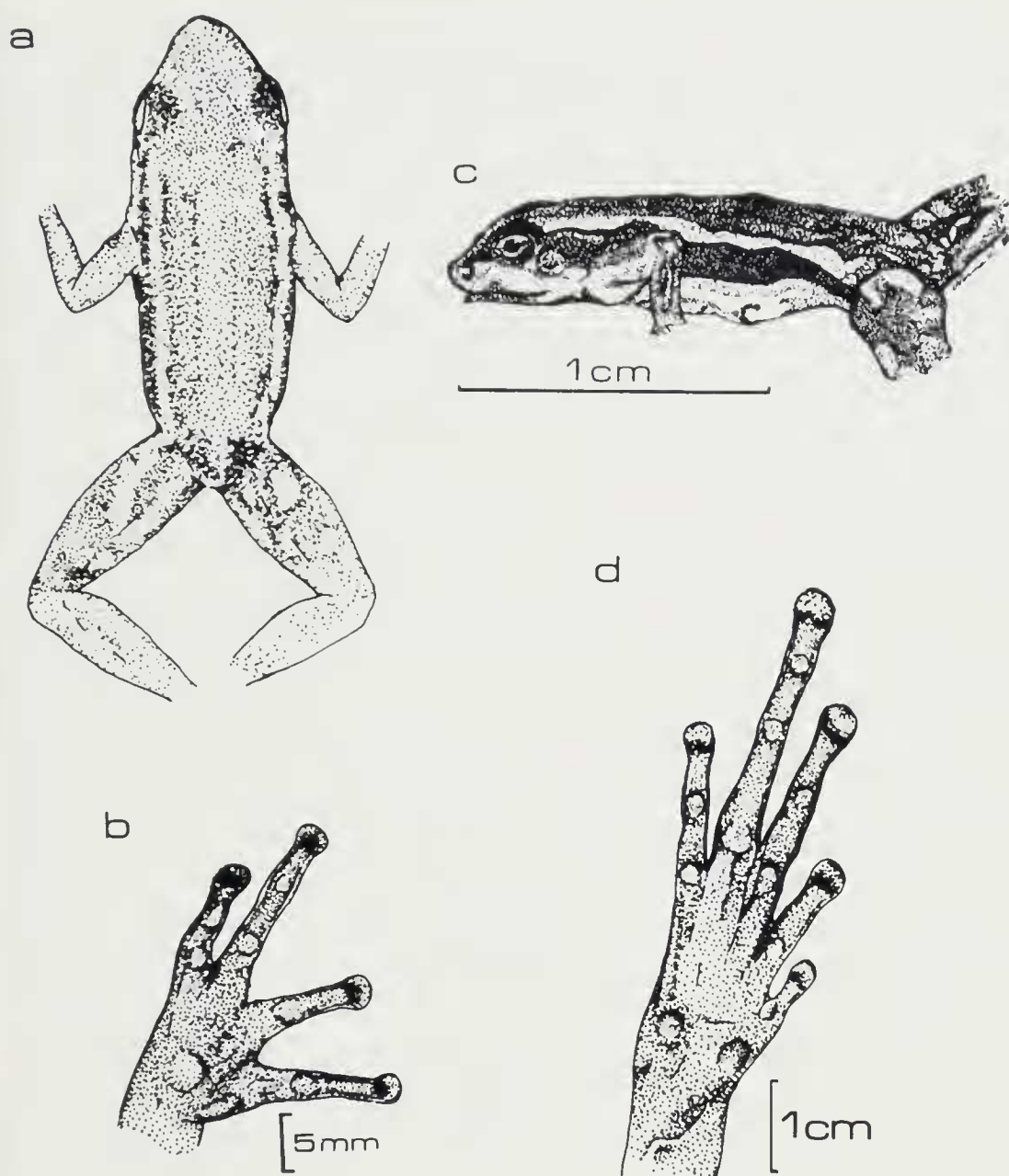


Figure 5. MCZ-A 103924, holotype of *Colostethus paradoxus*, (a) dorsal view; (b) ventral view of hand; (c) lateral view; (d) ventral view of foot.

gular, straight; loreal region vertical, flat; tympanum moderate, its upper half covered by skin; external metacarpal tubercle conical, protuberant; inner tubercle slightly more elongate, less protuberant; palm of hand smooth, with a ridge along outer margin; subarticular tubercles large, proximal of first finger and distal of fourth, smaller than others; first finger longer than second, second slightly shorter than last; third finger dilated; three outer fingers

with distinct lateral fringes; disks not broader than distal digital segments and all more or less of same size; disk of third finger not more than $\frac{1}{3}$ size of tympanum; a transverse, short, tarsal fold; metatarsal tubercles conical, prominent, with inner tubercle slightly more elongate than outer tubercle; plantar surfaces smooth, with a slight ridge along outer edge that continues to disk of fifth toe; a minimal web between toes II and III, and III and IV; except for first disk, all others slightly broader than distal digital segments; toes with lateral fringes; heel of adpressed hind limb extending anteriorly to between eye and nostril; a pair of vocal slits not too close to angle of jaw.

Dorsum smooth except for a few tubercles between insertion of hind limbs, and a fringe of tubercles margining fold above cloaca; loreal region and flanks smooth; ventral surfaces, including posterior aspect of thighs, smooth; posterior aspect of upper arm smooth.

Color. Above, solid light brown; two lighter colored dorsolateral stripes from posterior corner of eye crossing to groin and extending for short distance on thighs; black lines along the anterior or posterior aspects of forearms or thighs absent; loreal and temporal regions, including lower edge of tympanum, cream, this light color extending posteriorly as a ventrolateral stripe; a short brown streak below eye; thigh with a brownish bar between whitish area of proximal portion and with another one closer to knee; two elongate, whitish spots on posterodorsal aspect of thighs; forelimbs and rest of hind limbs uniform light brown; a canthal streak; flanks with a distinct and well-defined dark brown band from behind eye to groin; white ventrolateral stripe margined below by an irregularly margined brown streak; ventral surfaces infuscated and marbled on throat and limbs, but much less so on belly (except for the brown lateral streaks described above); whitish or unpigmented areas present in feet, metatarsal segments, and tibial segments.

Measurements (mm). Snout-vent 19.5; head length 6.2; head breadth 6.0; eye diameter 2.7; eye-nostril 2.0; eye-tip of snout 3.0; upper eyelid 3.4; interorbital space 3.1; femur 7.8; tibia 9.9; foot 8.2.

Discussion. The swollen third finger of the male places *Colostethus paradoxus* in group IV. However, this species is very

similar to some members of group II, particularly *C. kingsburyi* and a species from Cochabamba, Bolivia, reported by Edwards (1974). It also has the dorsolateral and ventrolateral stripes and the distinct and continuous dark lateral band that characterize members of group II, but in this respect, it is not different from *C. pratti*, which also has a dilated third finger and is a clear member of group IV. *C. talamancae* on the other hand, has dorsolateral and ventrolateral stripes and a dark lateral band but the males do not have a dilated third finger, which is the reason why Rivero (1988) suggested that it could be a member of group II in spite of its distribution, west of the Andes. This only serves to confirm the close relationship between groups II and IV, but whether a dilated third finger has arisen independently in different members of group II cannot be confirmed at present.

Rivero and Serna (1988) indicated that group IV was typical of western Colombia (and Central America) and that it did not extend southwards beyond Quevedo in northern Ecuador. Yet, *C. paradoxus* is from Southern Ecuador and it doesn't show any relationship to the only Ecuadorian member of group IV (still undescribed; Edwards, 1974). In spite of its dilated third finger it seems to be closer to the East Andean members of group II. If it is to be related to any member of group IV, it is to *C. pratti* and perhaps *C. latinasus*, but these are only found in Central America and in Colombia, west of the Oriental Cordillera.

Colostethus faciopunctulatus, sp. nov.

Figs. 6a–c

Holotype. MCZ-A 94751, an adult male from Puerto Nariño (3°46'N, 71°23'W, 15 km W. of Leticia), Departamento Amazonas, Colombia. Collector: R. Bleiweiss, 19 July 1977.

Paratypes. MCZ-A 94746–50, 94552–6, 93782, 94757–61, 96016–7, all from the same locality and collected by R. Bleiweiss, but 93782 collected on July 9, 94757–60 on July 19–21, 96016–7 on July 27, and 94761 on July 31.

Etymology. *Faciopunctulatus*, from the Latin *facies*, face, and *punctulatus*, dotted, in reference to the white dots on the loreal region, under the eye, and in the temporal region of this species.

Diagnosis. A medium-size *Colostethus* referable to group VI, with extensive webbing between the toes, generally with contrast-

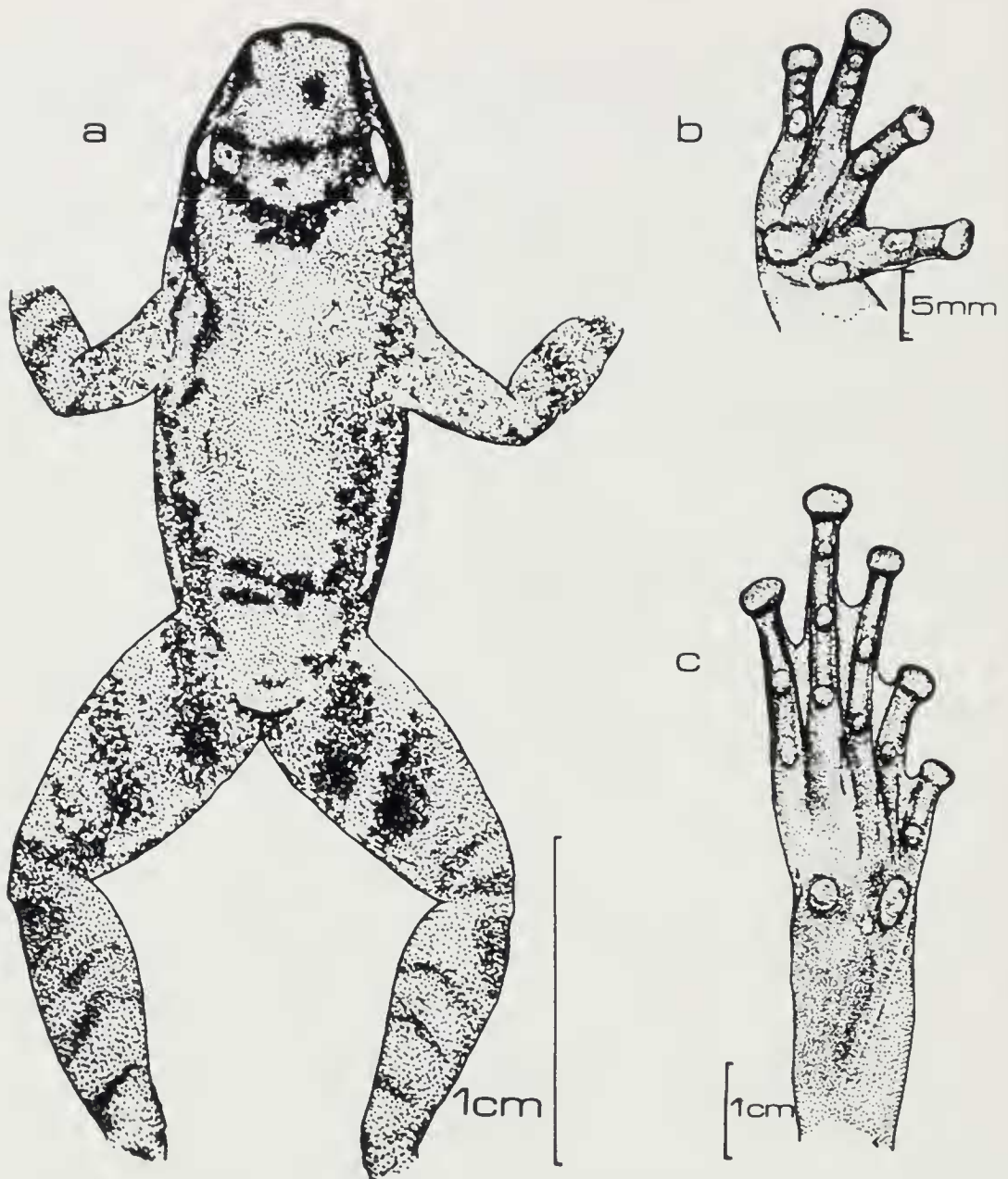


Figure 6. MCZ-A 94751, holotype of *Colostethus faciopunctulatus*, (a) dorsal view; (b) ventral view of hand; (c) ventral view of foot.

ing white dots on the loreal area, under the eyes, and in the temporal region, distinct ventral sexual dichromatism, the males having a blackened throat with white dots, short fingers, the second considerably reduced, no dorsolateral, ventrolateral, or oblique-lateral stripes, and a gray dorsum, usually with contrasting, black, V-shaped or transverse markings in back of the eyes and behind the sacral hump.

Description of Holotype. Tip of snout truncate, almost vertical when seen from side; nostrils lateral, slightly protuberant; tongue spatulate, indented behind, and about $\frac{2}{3}$ free; choanae small, ovate; canthus rostralis somewhat rounded, curved; loreal region slightly slanting and concave; tympanum moderate, not particularly distinct, covered posterolaterally by skin; external metacarpal tubercle rounded; inner tubercle narrow, elongate; palm of hand smooth, with no apparent ridge or fold on outer edge; subarticular tubercles moderate, not too prominent; fingers short; first finger slightly longer than second, second shorter than last; fingers without lateral fringes; disks moderate, of approximately equal size, broader than distal digital segments; disk of third finger a little more than $\frac{2}{3}$ size of tympanum; a short, oblique tarsal fold extending as a fringe along outer margin of first toe; metatarsal tubercles prominent, with outer tubercle rounded and inner tubercle elongate; plantar surfaces smooth, with a ridge along outer edge; pedal web intermediate; disks of toes broader than distal segments; first and last toe disks smaller than others; a distinct lateral fringe on toes; heel of adpressed hind limb extending anteriorly to middle of eye; a pair of vocal slits close to angle of jaw.

Dorsal surfaces smooth; loreal region and flanks smooth; abdomen and throat granular.

Color. Above, gray with a black, contrasting bar between the eyes, another V-shaped bar in back of the eyes, and a few smaller spots in back of the sacrum; a canthal streak; a short black bar between eye and base of arm; loreal region, area under eye, and temporal region blackish, with contrasting white dots; flanks a little darker than dorsum and with one or two white spots near inguinal region; a white or very little pigmented area in axilla; thighs and tibiae with indistinct dark blotches; posterior aspect of thighs indistinctly marbled black and tan; throat blackish (this color more intense on sides) and with white dots; abdomen white, with milky white dots on posterior end; arm tubercles white; ventral aspect of arms and posterior proximal aspect of thighs dark gray with white dots; no dorsolateral, ventrolateral, or oblique-lateral stripes; longitudinal black lines on the anterior and posterior aspects of arms or thighs absent.

Variation. There is a distinct ventral sexual dichromatism, the

males having a blackened throat with white dots while the females are uniformly colored. The white dots on the side of the head and the ventral portion of the thighs and forelimbs are either absent or inconspicuous in the females.

The first finger is slightly longer than the second in two male specimens (including the type), shorter than the second in both females and one adult male, and equal to the second in one male. The first finger is shorter than the second in two juveniles and longer in one.

The dots on the side of the head are present, in various degrees of distinctness, in all individuals except in one female, but the dots on the flanks are absent in four juveniles, and those on the lower aspect of the thighs are absent in most.

The dorsal color may be light gray or brownish gray, with contrasting dorsal markings, or very dark gray with imperceptible markings. The discolored area of the axillae is present in all specimens but may not be noticeable in those in which it is continuous with the ventral coloration.

Juveniles tend to be of a tan or light yellowish brown color with contrasting dorsal spots and better-defined bars on the legs. The white ventral dots are present in most individuals, and certainly on the throat of all males, but the abdominal dots may only be evident under a lens.

Granules are present on the abdomen but not evenly distributed in most cases and absent in some cases.

Measurements and Proportions. See Table 3.

Discussion. *Colostethus faciopunctulatus* is a clear member of group VI (as restricted), although in all members of that group the first finger is almost always shorter than the second, while in a few specimens of *C. faciopunctulatus* the first finger is slightly longer and in others it is equal to the second.

Distinctive features of *C. faciopunctulatus* are the white dots on the face, the very reduced second finger, and the usually contrasting dark bars or splashes on the dorsum.

The only member of group VI reported from eastern Colombia is *C. fuliginosus*, and the only members from eastern Ecuador are, besides *C. fuliginosus*, *C. nexipus* and an undescribed species from Río Azuela (between Quito and Lago Agrio), 1,740 m, Napo, Ecuador (Edwards, 1974).

Table 3. *Colostethus faciopunctulatus* measurements and proportions.

Catalog No.	Males					Females				
	94751	94749	93782	94746	Average	94761	94750	94752	Average	
SV	21.40	23.70	22.80	21.20	22.28	23.50	25.25	22.75	23.83	
HB	7.70	8.60	7.50	7.60	7.85	9.25	9.10	8.55	8.97	
HL	8.00	9.20	8.20	7.00	8.10	9.00	9.30	8.50	8.93	
ETS	3.00	4.20	3.80	3.90	3.73	4.10	4.20	3.50	3.93	
EN	2.70	2.25	2.00	2.30	2.31	2.65	2.40	2.30	2.45	
IOS	2.80	2.45	2.80	2.20	2.56	2.50	2.90	2.25	2.55	
UE	2.20	2.15	2.60	2.20	2.29	2.40	2.55	2.10	2.35	
ED	3.20	3.55	3.00	3.80	3.39	3.50	3.65	3.30	3.48	
DT	1.50	1.40	2.10	1.20	1.55	1.45	1.60	1.65	1.57	
LF	10.00	11.00	11.50	10.01	10.63	11.70	11.60	11.40	11.57	
LT	10.10	11.10	10.15	10.70	10.51	11.40	10.60	10.60	10.87	
LFT	8.90	9.95	10.50	8.70	9.51	10.65	9.60	9.00	9.75	
HB/SV	0.36	0.36	0.33	0.36	0.35	0.39	0.36	0.38	0.38	
HL/SV	0.37	0.39	0.36	0.33	0.36	0.38	0.37	0.37	0.37	
UE/IOS	0.79	0.88	0.93	1.00	0.90	0.96	0.88	0.93	0.92	
DT/ED	0.47	0.39	0.70	0.32	0.47	0.41	0.44	0.50	0.45	
ED/ETS	1.07	0.85	0.79	0.97	0.92	0.85	0.87	0.94	0.89	
ED/EN	1.19	1.58	1.50	1.65	1.48	1.32	1.52	1.43	1.43	
LF/SV	0.47	0.46	0.50	0.47	0.48	0.50	0.46	0.50	0.49	
LT/SV	0.47	0.47	0.45	0.50	0.47	0.49	0.42	0.47	0.46	
LFT/SV	0.42	0.42	0.46	0.41	0.43	0.45	0.38	0.40	0.41	
LF/LT	0.99	0.99	1.13	0.94	1.01	1.03	1.09	1.08	1.07	

For key to characters see Table 1a.

The Río Azuela species also has white specks on the upper lip, but the dorsum is chestnut brown with faint white spots, adult females grow to 28–31 mm, and the color of the belly is light with darker spots.

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